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ABSTRACT

Elementary teachers must make thousands of decisions about their teaching practices every day. From whom should they first seek a response? Who should be asked the next question? Will the students be in groups for this activity or do it alone? While many science educators have clear visions of strategies they should employ in science classrooms, the reality does not always fit their vision. This paper suggests that focus on the nature of science, process skills, and integrated teaching methods will increase the confidence of new teachers. In addition, it will develop an effective strategy that supports new elementary teachers' science instruction. (Contains 19 references.) (CCM)

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"R-BEST" RATIONALE FOR TEACHING ELEMENTARY SCIENCE: A STUDY OF FIRST YEAR TEACHERS' PERSPECTIVES ON THEIR PERSONAL RESEARCH-BASED ELEMENTARY SCIENCE TEACHING RATIONALE

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Every day elementary teachers must make thousands of decisions about their teaching practices. From whom should they first seek a response? Who should be asked the next question? Will the students be in groups for this activity or go it alone? The decisions are endless. These kinds of decisions become easier with experience. But, what are the beliefs and subsequent choices of novice teachers?

What does science teaching look like in first year elementary teachers' classrooms? More importantly, what do these teachers believe students should experience during science time? While few would argue that a main goal for an elementary pre-service teaching program includes attempting to prepare students to be effective elementary science teachers, many would argue about the most appropriate ways of getting them there (Tillotson and Yager, in press, Penick, 1988). The National Science Education Standards (NRC, 1996) also make it clear that teachers must have theoretical as well as practical knowledge and abilities about science, learning, and science teaching. How they gain this knowledge and skills is certainly debatable.

While many science educators have clear visions of strategies teachers should employ in science classrooms, the reality does not always match their vision. Teaching beliefs and actual practice have been shown to be dissimilar or not always congruent. Gee and Gabel (1996), for instance, discuss the mismatch between what teachers say they do and what is really observed in

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the first year classroom. These authors found that only one of four participants surveyed was actually doing the inquiry teaching and learning that was being professed by all. As a means to bring perceptions of reality and actual practice, Clough (1992) discusses the need to value the importance of science education research to inform actual practice. While Clough argues at the secondary level of science instruction, research-based methods could also impact and influence elementary teacher actions. It could be then be logically argued that students might ultimately experience a greater amount of appropriate science instruction in their elementary classrooms provided their teachers have a sound rationale for teaching science.

Given a well-known negative tendency toward science, what do elementary teachers know about, believe in, or feel comfortable with when it comes to what and how they teach science? Will they believe they should teach science as they were taught in a lecture course or adopt teaching strategies which are acceptable in the new school where they were just hired? Elementary teachers have long been included among teachers that classically have a disinterest in science and in teaching science. One source for this disinterest can be attributed to courses they experienced in high school (Watters and Ginns, 1995). And, traditional lecture-format science classes new teachers might have experienced in college may help strengthen negative perceptions.

Whereas high school teachers are typically responsible for teaching a single discipline, elementary teachers have a wide array of subjects to teach. How they teach these various subjects is certainly a complex endeavor. Despite the complexities, the reality is that the actions that teachers exhibit in their classrooms ultimately have profound impacts on the kind of learning that their students experience. Raizen (1994) for instance, discusses teaching processes, actions, or attributes of effective teachers of elementary science. She states the effective factors for

teaching include being highly motivated and enthusiastic. How or where do new teachers acquire these attributes? Some researchers say that having a sound background in research-based methodology is the way to better science teaching (Penick, 1988, Clough, 1992, Clough and Berg, 1997, Tillotson and Yager, in press, Veronesi, 1998). Specifically, these authors conclude that developing a research-based rationale for teaching science provides a key influence in the professional development of pre-service teachers.

Literature indicates that Penick (1988) originated the discussion of the development of a science teaching rationale as a necessary prerequisite for a beginning science teacher. Clough (1992) furthered the concept of the rationale. Penick argued that beginning teachers who develop a research-based rationale for teaching science are better prepared to self-evaluate. And, having this ability seems to be very closely related to the art of being a reflective practitioner. In short, teachers have the opportunity to compare the model of teaching science they outlined in their rationale to the teacher they have become at any point in time. Penick also asserted that teachers who have a goal-centered research-based rationale for teaching science will more likely stay in tune with science education reform and examine how their teaching should be modified to reflect this new knowledge.

What is "Best" Teaching?

John Penick and Bob Yager (1993) discuss exemplary practices or teacher characteristics of the best in teaching that include:

- Providing a stimulating and accepting environment.
- Having high expectations of themselves and their students.
- Challenging students beyond ordinary school tasks.

- Being models of active inquiry.
- Not viewing classroom walls as a boundary.
- Using societal issues as a focus.
- Being extremely flexible in their time, schedule, curriculum expectation, and views of themselves
- Providing systematically for feelings, reflections, and assessments.
- Requiring considerable student self- assessment.
- Expecting students to question facts, teachers, authority, and knowledge.
- Stressing scientific literacy.
- Wanting students to apply knowledge
- Seeking science excellence.

Since these characteristics are said to be exemplary, they can be used in various ways as the core of a new teacher's rationale. And, while these seem to be what science educators would consider to be traits of high quality teaching and learning, it might be challenging for any single individual to possess all of these traits at all times. Surely, some individuals would be stronger at one trait over another and these strengths would vary over time.

Methods courses are a logical place for teacher candidates to acquire skills and attitudes that relate to the list of exemplary characteristics. Therefore, it was hoped that having teacher candidates write and defend their own elementary science teaching rationale during their methods course would provide support to them as they became new teachers who would be growing toward the exemplary traits outlined by Penick and Yager (1993). Since one of the roles of science methods instructors is to have an impact on their students, having teacher candidates in science methods courses can be a powerful way of creating a positive impact on new teachers.

Science educators have long suggested many different research-based methodologies or ideas for teaching science. Methods such as cooperative learning (Ellis and Whalen, 1992) or the use of questions (Penick et. al. 1996) are thought to be more efficient for increased learning in science than direct instruction. Whether implicitly or explicitly stated, these teaching approaches are grounded in research on teaching and learning.

Arguably, elementary teachers have the most difficult job incorporating research-based methods for teaching, especially science. They must address and teach the entire range of subject areas including math, science, social studies, and language arts. A need to feel knowledgeable in the subject content areas takes priority over learning about the most appropriate research-based pedagogy. Ultimately, the teaching strategies they use for the various subjects are influenced by a myriad of factors. These can include prior knowledge from methods courses, what is acceptable practice in the school where they are now teaching, what they believe to be right based on what has worked thus far, or their own experiences as students.

Beginning teachers' beliefs about their efficacy and their use of sound teaching methods are fragile (Soodak and Podell, 1997) and are formed prior to any methods instruction (Cronin-Jones and Shaw, 1992). Teacher candidates often ask themselves, What are the best ways for me to be teaching this material? Who should I believe? Or, What is right? The development of the research-based teaching rationale could aid in the answers to these questions about effective teaching strategies and attributes (Penick, 1988. Clough, 1992). However, while these suggestions seem logical, little evidence can be found in the literature regarding the impact of an elementary science teaching rationale on novice or beginning teachers (Veronesi, 1998).

Teachers who feel effective are able to pay more attention to academic instruction. While there are teacher attributes associated with teacher efficacy, little is known about the interactive

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processes that lead to and support teacher efficacy. Soodak and Podell (1997) suggest that many elementary teachers lose their confidence during their first year in the classroom. Yet, they suggest this confidence loss may be lessened if teachers are better prepared to enter the profession. Others have suggested that reducing the level of expectation for knowing the science content knowledge (Cox and Carpenter 1989) can also increase confidence. These authors suggest that a focus on the nature of science, process skills, and integrated teaching methods will increase the confidence of new teachers.

History

The developmental process of reflecting on and writing a science teaching rationale is one strategy that can address the concern of lower confidence. What impact does the process of writing and defending a rationale have on beginning teachers? The intent of the rationale paper used in an elementary science methods course was to help beginning elementary teachers strengthen their confidence toward science instruction. This pilot study begins discourse on a longitudinal research project in science teacher education to develop an effective strategy, which supports new elementary teachers' science instruction.

Teacher candidates enrolled in a science methods class during the fall of 1996 were assigned to write and orally defend a Research-Based Elementary Science Teaching Rationale for teaching science in their future classrooms (See Appendix). Students were given the first two months of the semester to draft an initial paper for mid-term, get instructor feedback, rewrite and resubmit, then finally orally defend their rationales. The rationale included their goals for their students' learning about science or how the world works and a personal vision of how learning

should look in their classrooms. However, the primary focus of their papers included specifying the methods they would employ in their science teaching.

Each teaching action they envisioned as an alternative was to be based on relevant research. For example, if one of their goals for their students' science learning was to have students communicate their evidence to other group members, they might cite cooperative learning as a research-based means of realizing their goal. Whenever the teacher candidates referred to a teacher action, they were to show evidence of its learning effectiveness in the literature.

Various teaching and learning strategies for science teaching were modeled for students in their methods course. Each model (learning cycle, inquiry, open-ended questioning, wait-time, etc.) was research-based and the teacher candidates were free to choose those strategies that best fit their goals for their students. Some topics that received a great deal of perusal included constructivism, inquiry, questioning, Science, Technology, and Society (STS), cooperative learning, and alternative and performance assessment.

The final evaluation of their understanding of teaching elementary science came in a fifteen-minute oral defense of their rationale during finals week. Students were assessed on their completeness of thought and how well they had incorporated research-based methods into their explanations (Rubric in Appendix). As with any assessment, the quality of explanation ranged from very strong and articulate with substance to very weak, inarticulate with little knowledge of any research-based literature. The teacher candidates graduated the following May (1997) and began their job searches.

The Survey Procedure

Since this study sought to obtain the thoughts and attitudes of past methods students toward their *R-BEST* Rationale, it is mainly qualitative in nature (Interview Schedule in Appendix). Qualitative research can provide a very thick (Geertz, 1973), rich, and detailed description if it originates from the participants. Respondents were carefully chosen for this study rather than at random so that the greatest amount of data could be obtained. Selecting the respondents in this manner can be viewed as "purposive" as described by Chein (1981) or as "purposeful" by Patton (1980). Merriam (1988) further describes purposive sampling as being a way to discover and understand phenomena from a source known to provide the best possible information.

Eighteen months after writing and defending their *R-BEST* Rationale these new teachers were contacted by telephone. While telephone interviews have limitations some have found a fair amount of success with them (Conklin, 1997, Ouimet and Hanson, 1997). However, Conklin (1997) points out that telephone interviews are one of the most dominant and popular survey techniques today. As with any survey technique, obtaining quality data is of utmost importance. One way of increasing the integrity of the data obtained by using the telephone comes from creating a quality survey and training an interviewer (Suskie, 1992). The survey used for these interviews is located in the appendix and the graduate student who performed the interviews was trained in asking the initial questions and follow-up probing questions.

Respondents for this study were asked a series of open-ended questions to determine the impact of their elementary science teaching rationale that was written almost two years earlier. The interview schedule was designed to first provide the researchers a window into the classroom science experiences of the students being taught by these first-year teachers. As each interview proceeded, questions became more focused on the *R-BEST* Rationale and its impact on

their current teaching of science. As the Table 1 demonstrates, out of 35 possible respondents, the eleven that were contacted and currently teaching were all willing to participate in the study.

Table 1
Number of Teacher Candidates and
Potential Participant Status: fall 1996 (n=35)

1. Individuals who had a teaching position for 1997-98 school year, had the opportunity/expectation to teach elementary science, and were amenable to a phone interview. In short *the study participants*. **n=11**

2. Wrong numbers, did not return calls after <u>three</u> attempts (answering machines), no forwarding number, no answers. There is currently no data available on these individuals. **n=10**

3. Was on a team and did not teach a science component. **n=1**

4. Were not employed as teachers as of fall 1997. However, five of these individuals obtained teaching positions for the 1998-1999 school year and will be involved in a similar study in 1999. **n=13**

<u>Results</u>

Each of the following participant quotes was chosen as representative for the majority of responses. While a few teachers expressed frustration in their perceptions of teaching science, the researchers felt that most of these comments resulted from pressures within a particular district. In one instance, frustrations in teaching science were caused as a result of the focus on the teaching of reading. Following are some comments intended to let the reader understand what these new teachers thought. While each respondent was known at the time of the interview solely by the graduate student interviewer, they were indeed anonymous as this paper was drafted. Each of the eleven respondents was tracked with a number that will be indicated prior to quotes. As was suggested by Suskie (1992), initial questions should invite the respondent into a conversation in a non-threatening manner.

When asked how much time their students experienced science, most respondents indicated that they taught science nearly every day of the year:

#9: "I teach science at least one hour a day every day of the week."

Respondents were then asked to report on what they recalled as their students' most memorable experiences in science that past year. Interestingly, each had a different example of student involvement in science and showed that multiple science content areas were indeed being covered at the various grade levels:

#3: "The unit on crayfish and natural surroundings was most memorable. As a culminating activity, we went to Ellison Park to catch our own crayfish. We observed them for a day and then let them go."

#7 "The dinosaurs unit was my students' most favorite unit. They made fossils and pretended they were paleontologists!"

#9: "We made volcanoes from scratch! Students were very involved because it was so much a hands-on experience for them. This was a topic that they were all interested in."

As questions continued on the interview schedule, there was an increasing emphasis on the *R-BEST* Rationale and things that informed their elementary science instruction. As with the initial paper, these teachers were asked about their current goals for their student's science learning:

#4: "For my students, to have a greater sense of their surroundings and to take greater notice when they are out in their environment."

#6: To enjoy and be interested in what they are doing. I learn along with my students. When my students see me interested in something they become more interested. My students learned a lot during science last year because they were interested in it. We had a good learning environment. There were a lot of conversations that would arise from our discussions. My students kept asking and learning more information all the time."

#10: I want my students to question everything. I would like them to ask why things happen the way they do and search and find out the answers. To be able to solve problems on their own."

Respondents were then asked to reflect back to their methods class and detail what they felt and thought about their instructor's goal for the *R-BEST* Rationale. In short, what did they think his goals were in assigning the *R-BEST* Rationale?

#1 "So we could look at ourselves. To set goals for ourselves for when we became teachers, and that the goals would already be in place."

#2: "To drive me crazy! But really, to make us more aware of science and how we feel about it so that we could put our goals into perspective. It was a soul searching experience and it made me think about teaching."

#5: "[The instructor] wanted us to be more comfortable with science. He wanted us to learn the important aspects of science [and teaching science] such as questioning and wait-time. He also wanted us to overcome our fears of science so we could teach it in our classrooms."

#6: "[The instructor] wanted us to dig deep within ourselves to see what direction we wanted to go as teachers. He wanted us to think about what kind of teacher that we wanted to be and to see if we were capable of being that kind of teacher. [The instructor] wanted us to be more student-oriented. I think now that kids learn through their experiences. Teachers should use everything in our environment to teach students. Teachers need to make things real for their students."

Conversely, one of the eleven respondents saw the exercise of writing and defending the *R-BEST* Rationale as a lesson in busy work- a waste of time.

Discussion

Results of this pilot study merit continued research on the impact of a science teaching rationale for elementary pre-service teacher candidates. The overwhelming views of the eleven respondents in this study, who obtained teaching positions immediately after graduation, clearly indicated that thinking about, writing, and then defending their *R-BEST* Rationale had a powerful impact on how they viewed and taught science in their first year of teaching. While one respondent felt that writing the *R-BEST* Rationale was mostly busy work, those who felt very

positively about the experience were able to articulate the impact it had on their beliefs as a teacher in terms of science instruction.

It seems logical then, that some connection to teacher growth, reflection, and confidence in teaching elementary science may be attributed to the process of writing and defending the rationale paper. While an argument could be made that the lengthy telephone interview about science teaching, almost two years after the class, might be cause enough for individuals to provide more positive answers, the respondents were able to individually articulate clear and positive responses to questions about teaching elementary science. This could also be indication that long-term learning about teaching science did occur in ways suggested in the literature and was being acted upon in the first year of teaching.

Tillotson and Yager (in press) conducted research with new teachers in the area of secondary science education. These researchers found positive attributes for individuals writing a science teaching rationale. While focused on secondary science teaching, it does suggest that teacher candidates writing a research-based rationale might also strengthen effective science teaching at the elementary level. Interestingly, the preliminary results of this current study indicate that those students who successfully developed and defended their own *R-BEST* Rationale and obtained a teaching position were indeed teaching science to varying degrees. National trends of science avoidance in the elementary grades suggest that any science instruction at all would be an improvement. While these self-reports must be validated with observations, photo copies of lesson plans, student assessments, and videotapes, these newly hired teachers stated very lofty and inspiring goals for teaching their students science. Most did so with thoughtful enthusiasm.

A few respondents indicated that they would revisit their *R-BEST* Rationales to see how their current thinking compares to their initial statements. Two new teachers who were interested in

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changing their current teaching position indicated the intent to reflect on their *R-BEST* Rationale prior to interviewing for a new position. They now seemed to realize the importance of being clear, scholarly, and articulate about teaching elementary science, especially during a job interview.

This study does not imply cause/effect relationship between the process of crafting a *R-BEST* Rationale and teachers' actual practice. However, there is support for further research on this type of assessment for use in elementary science methods courses. When John Penick (1988) initially discussed the need for a similar document for secondary science teacher candidates he asserted that that a methods class without a science teaching rationale was missing a vital component. Reports from teacher educators in secondary science teacher education (Penick, 1988, Clough and Berg, 1997, Veronesi, 1998, Tillotson and Yager, in press,) provide a logical argument for new elementary teachers to have their own *R-BEST* Rationale.

Perhaps it is time to consider an *R-BEST* Rationale as a form of assessment for elementary science methods courses. Expecting students to write and orally defend their thinking on research-based elementary science teaching prior to employment offers a way for new teachers to begin the habit of reflection about research-based methods of teaching elementary science. A rationale acts as a vessel that takes teacher candidates into the scholarly pedagogical research that they can use in a practical way (Clough, 1992). Ultimately, this may encourage and support new teachers' efforts to have their students learn about science and to continue their own reflections on how teaching and learning of science should exist in their own newly acquired elementary classrooms.

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Appendix

Interview Schedule

1. I'd like you to please describe a typical day or week's general schedule in your classroom. That is, what subjects or classes did your students experience in general from hour to hour during a typical day last year?

2. Describe some of the most memorable kinds of **experiences** your students had with science this past year with you?

3. What would you say are **your goals for your students** when it comes to their learning of science?

4. What factors determine the goals you set for your students when it comes to them learning science?

5. How comfortable are you at this point in teaching elementary science?

6. What have you found to be **easiest** for you with regards to teaching elementary science?

7. What have you found to be the **most difficult** for you with regards to teaching elementary science?

8. Now I would like you to think back about some of your learning at Brockport. During that time you were assigned to write and defend your own *personal Research-Based Elementary Science Teaching (R-BEST) Rationale* for your future teaching of elementary science. What do you think the instructor's **goals** were for you in writing and defending *your own* elementary science teaching rationale?

9. Where or how did you obtain the ideas to write your rationale paper?

10. What were your feelings during the time your were writing your elementary science teaching rationale?

11. How might your elementary science teaching rationale have influenced your student teaching and your cooperative teacher?

12. What positive aspects came out of writing and defending your science rationale paper?

13. What purpose might your science teaching rationale have served when you were looking for a job?

14. How closely did what you wrote as your "*vision of teaching elementary science*" in your rationale paper match what you experienced in teaching science to your students this past year?

15. What relationships would you cite as examples **between what your students actually did** and what you wrote in your science teaching rationale?

16. Now that you have finished your first year (or wherever they are in their career), what role will/did your rationale play in your science teaching? That is, in what subtle or overt ways have you used or will use the ideas from your elementary science rationale?

17. How might your science teaching rationale serve to defend your techniques or methods of teaching elementary science if you had to explain any new science teaching ideas that you were trying employ in your classroom- Let's say to administrators or parents?

18. As a teacher with one-year experience, given the task to write and defend another elementary science teaching rationale, what would you now include in it to make it most relevant for your science teaching at this point?

19. After having experience with students, how do you now view the effort you invested in writing and defending your rationale paper?

20. What advice would you offer to a new pre-service teacher in the elementary science methods class who is getting ready to write their own elementary science teaching rationale?

21. Now that you are going to begin your second year of teaching, (or wherever they are) how might some of the ideas in your rationale paper be used in your next year?

22. If the instructor's main goal for writing and defending a personal R-BEST Rationale paper was to get pre-service teachers thinking about teaching science with research-based methods or ideas when they began teaching, what would you suggest to make the elementary science teaching rationale and its oral defense more meaningful for pre-service teachers?

Each respondent was asked each question in the same order. When respondents were vague, the interviewer attempted to ask further probing questions for clarification.

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Research-Based Elementary Science Teaching Rationale: A Vision of Research-Based Elementary Science Teaching Methodologies in My Future Classroom

Good teaching is no accident. It is not done simply willy-nilly, nor on the basis of one's personal feelings of what is right and what is wrong.

Expectations

Research has shown that real learning or greater understanding about the universe occurs when the teaching of science occurs by acceptable methods. These methods require a teacher to know and truly understand a great deal in terms of research-based pedagogy as well as the nature of the scientific enterprise (namely questioning, curiosity, testability, repeatability, and communication with peers). Good elementary science teaching is not a product of someone simply "thinking" one way of teaching is better than another. On the contrary, there are sound teaching strategies that have been researched over the years and have been found to be better than others in creating real science learning situations for students. That said…

Your challenge is to determine which teaching strategies best fit your science goals for your future students and write a teaching rationale that is first person, double-spaced, 12 Times/Roman font, and <= 5 pages in length.

Your elementary science teaching rationale should be succinct and personalized, yet still reflect suggestions from various literature sources so that you can defend what you have written during finals week in a 10 to 15 minute individual exit interview with Dr. Veronesi. Your rationale will contain at least ten different citations from authors suggesting better ways of teaching science. (e.g. cooperative learning strategies = Johnson and Johnson, Mary Budd Rowe = wait-time I and II during questioning of students). ERIC and other periodicals such as the Journal of Science Teacher Education, The Journal of Research in Science Teaching, Science and Children, Science Scope are excellent sources for articles and easily found via computer terminal. The Internet can now be accessed as well. The document itself is only half the task. Your knowledge about what you write about is the other. Know the research you discuss well enough to talk about in your exit interview.

Ultimately, your rationale paper should read as a smoothly flowing document. The reader (me, a principal, a parent, etc.) must be able to understand it. That is, get a clear picture of what would be seen in your classroom when students are "doing" science. Your research support should indicate you have learned something of an academic or scholarly nature (your reading of articles) this semester and should link your goals and actions together with what you have found in the literature. You should address your knowledge of good teaching from various literature sources and how you plan to "get there" in a practical sense. A time will be scheduled for you to discuss and defend your paper at the close of the semester. Therefore, you should believe what you write.

Your elementary science teaching rationale will certainly evolve as your experiences increase. However, when you leave Brockport, you will have a research-based plan for what happens in your classroom. Keep in mind that YOUR ELEMENTARY SCIENCE TEACHING RATIONALE SHOULD REFLECT YOUR GOALS FOR YOUR STUDENTS.

Rationale papers from former students are in the reference department of the library on hold under: EDI 416/516 Science Rationale.

Rationale Rubric

Criteria in this rubric must be addressed in your personal science rationale:

After you have re-read your drafts several times, use this checklist to make sure you have addressed all these criteria:

1._____What your goals for your students are. Number each and place them at the top of your first page.
2._____What the National or NY State science standards discuss about teaching science and why science should be taught at the elementary level.
3._____What **specific actions** you would like your students to be doing while they are involved in a science lesson as a result of your teaching. (You must be specific and cite actions, behaviors, etc.)
4._____How these student actions might lead to fruition of your goals for them.
5._____What you as the teacher will be seen doing in your classroom to accomplish your goals (be specific!) Try phrases such as, "In my classroom, you will see..." or "What I would like to do in my classroom as a result of what I have read is..." etc. Whichever you choose, the reader must be able to envision ***your*** actions in ***your*** classroom and *reasonably* determine that they result in the interactions you desire and that which is desired from the literature you find.
6._____How your actions might enhance student attainment of your goals and the science learning they will experience (Cite the research here): For instance: *"When I question students I will expect a response and will wait an appropriate amount of time as suggested by Rowe (1981). Doing so gives the students time to think and respond with greater confidence."*
7._____How you will decide on what science content to involve students in.
8._____How you and other researchers see science as integrated with other curricular areas.
9._____The various ways you will assess student attainment of your goals or the science lessons you teach (Cite the research here also).
10._____How you plan to reflect upon your own teaching.
11._____A list of your references following a format similar to the one below:

Rowe, M. B. (1991). Assessment implications of the new science curricula. In: Kulm, G. Ed. and Malcom, S. (Eds.) *Science Assessment in the Service of Reform*. AAAS, Washington D.C.

1. **Due: First draft of rationale paper, October 26th.**
2. **Due: Final of rationale paper due December 4th.**
3. **Exit Interviews are during finals week.**

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